ences of opinion may obtain. However, taking the cases I have presented it is evident that chronicity must be admitted as established beyond cavil. Case IV., the man who fell from the bridge, has now been six months in bed and though somewhat improved is far from well. Case V. is now of ten months' duration and is still under treatment. Neither case involves litigation. Cases III. and VI. have each received damages, and yet two years after the accident, though slightly improved, each preserves the prominent features previously present. Case VII. is, I believe, still unsettled. However, it is improbable that anyone qualified to judge would fail to recognize the physical condition of the back. This, at the end of two years, is still very marked. Finally, Case VIII. still presents at the end of four years the more important points fully intact. Some improvement must be admitted with regard to all of them, and yet the photographs taken, all very recently, speak for themselves.

In regard to the disappearance of so-called "litigation symptoms," made so much of by Page and others, my observation has been that when a claim for damages has been settled, the mental condition improves very much. A man who, perhaps, is poor is suddenly raised to a condition of relative wealth. No wonder that hypochondria often disappears and is replaced by buoyancy and exaltation. It were strange indeed if it were otherwise. After a while, however, I have seen the old mental condition partly reëstablish itself while the physical condidition had undergone no change save that which could be accounted for by the slow repair of time.

Lastly, the cases which I have presented were selected because of the marked and pronounced condition of the back. I do not, however, wish to create the impression that every case should present the back symptoms to an equal degree in order to be considered genuine. As a matter of fact, in a large number of instances of *bona fide* railway back the symptoms are far less evident than in the cases here detailed. To cite illustrations would add unnecessarily to the length of this paper. I will simply repeat that careful application of the various tests for eliciting pain and spasm cannot fail to evoke a reply if trauma be really present.

INOCULATIONS FOR YELLOW FEVER BY MEANS OF CONTAMINATED MOSQUITOES.

BY CHARLES FINLAY, M.D.,
OF HAVANA.

AT the time when my former article was written[1] I observed that the figures there given were not considered by me, "from a statistical point of view, to afford any definite clew either in favor or against the prophylactic value of my inoculations." In fact, neither the number of my experiments nor the length of time during which the parties inoculated had been under observation could at that time justify any scientific deductions. Now, however, the case is different; I have on record a series of sixty-seven persons, including all those whom, in collaboration with Dr. Delgado, I have inoculated since 1881, by means of contaminated mosquitoes, in the manner explained in my previous article. All were Europeans, with few exceptions natives of Spain, young adults recently arrived in Cuba and presenting the usual conditions which imply liability to contract yellow fever. Among the sixty-seven a considerable number, fifty-two, are considered as acclimated, either from the fact that they have resided in the infected quarters of the city of Havana (the old town) during periods varying between three and seven years, or in consideration of their having experienced fevers which are attributed to the yellow fever infection, though of a mild type in the vast majority of the cases. Two parallel groups, one of thirty-three *inoculated* persons and the other of thirty-two *not inoculated*, both offering to all intents and purposes such similarity (as to susceptibility and exposure) as can seldom be obtained, afford a reliable foundation for a fair and unbiassed comparison. I consider, therefore, that the time is now come when some practical inferences may be drawn, and, as far as they go, I am happy to say that they agree with my former expectations.

---

[1] "Yellow Fever: Its Transmission by Means of the Culex Mosquito." AMERICAN JOURNAL OF THE MEDICAL SCIENCES, October, 1886, p. 395.

The statistical method of demonstration is, at best, a tedious and a slow process, but it can boast of great triumphs, such as are recorded in the instances of Jenner and Pasteur, who have had to rely exclusively on its results in order to bring over to their views the balance of scientific opinion and public favor. They represent, moreover, two distinct applications of that method. Jenner vaccinated indiscriminately a vast number of subjects in order to verify subsequently the immunity enjoyed by the majority when exposed to the variolous infection. Pasteur, on the other hand, adopted the system of carefully registering every person inoculated by his method after being bitten by a rabid animal, and afterward comparing the statistical results observed in them with the average proportion of hydrophobic cases developed in the non-inoculated after similar bites. I have chosen Pasteur's plan, believing it to be the more reliable and more applicable to our case. It cannot be denied, however, that, limited as we have been in our field of experiment, our numbers cannot compare with those of the glorious French investigator, nor that we labor under a disadvantage in having to deal with a disease which so far has not been proved to occur, under ordinary circumstances, in lower animals. Thus obliged to confine our investigations to the human species, it could hardly be expected of us that we should carry our scientific zeal to the point of seeking, through a bolder application of our inoculations, to determine a violent attack of the disease—thereby carrying conviction, no doubt, to the sceptical mind, but at the risk of having betrayed the confidence placed in us.

A somewhat specious objection was recently raised against our mosquito-inoculations, on the plea that the proboscis of the insect not being susceptible of sterilization many accidental germs might be inoculated together with or instead of those of yellow fever, supposing the latter to exist in the proboscis of the contaminated mosquito. To this hypothetical imputation I can oppose many facts. In none of our numerous inoculations has such an occurrence been observed, nor has it ever been proved that the acclimated inhabitants who are constantly being stung by those insects acquire thereby any specific infection. I have on several occasions introduced into sterilized tubes provided with agar jelly mosquitoes that had stung acclimated persons. In most of these experiments, after several days' confinement, the insect died for want of food, and yet not a single colony appeared upon the jelly; when any growth was developed it mostly consisted of fungi, the spores of which had probably been introduced accidentally while transferring the insect from one tube into another. From this curious result I infer that the insect has some means of rendering its outer surface aseptic, and probably does so through a very peculiar operation which I have often seen it perform. This consists in collecting with its hind or middle legs a secretion expelled from the posterior part of its body, and besmearing very persistently with it every part of its body—legs, wings, head, and proboscis. I also believe that we are justified in admitting that the liquid which the insect employs to lubricate its complicated sting, and which being poured into the wound occasions the painful sensation felt by its victim, must vary in its chemical composition in different species of gnats, thereby accounting for the difference in the sensations occasioned by their sting. It is quite possible, therefore, that the presence of that liquid may constitute in the sting of the culex mosquito an appropriate soil for the development of the yellow fever germ, whereas the same germ would remain sterile in the sting of other species of culex.

Another objection of a clinical character was made to our considering as cases of mild yellow fever the attacks of non-albuminuric fever observed in our inoculated subjects, either within the plausible limits of incubation or later on, with the result of rendering them immune against subsequent attacks of albuminuric yellow fever. To this objection an answer is given by the present statistics themselves, inasmuch as among fifty-six inoculated and non-inoculated subjects mentioned therein and who have resided during periods varying between three and seven consecutive years in the city of Havana, *one-half* have acquired their immunity exclusively through non-albuminuric attacks suffered during the first three years after their arrival here. If the objection turned out to be well grounded, it would only prove that what we had considered as a partial immunity had been a complete one in ninety per cent. of our inoculated subjects.

I have distributed our sixty-seven inoculated subjects into six groups:

GROUP I. Fifteen—whose observation is yet incomplete, not having resided three years in Havana, nor experienced any form of yellow fever.

GROUP II. Twelve—who experienced, within a period of days varying between three and twenty-five, after the inoculation, an attack of fever with or without albuminuria.

GROUP III. Twelve—who did *not* experience any pathogenic effects within the twenty-five days following the inoculation, nor any other febrile attack subsequently, that could be referred to the yellow fever infection.

GROUP IV. Twenty-four—who did not experience pathogenic effects within the twenty-five days, but subsequently had fevers of a mild type, either non-albuminuric or with slight or transient albuminuria.

GROUP V. Three—who experienced no pathogenic effects after the inoculation, but were subsequently attacked with regular albuminuric yellow fever (severe in two cases), but recovered.

GROUP VI. One—who not having experienced pathogenic effects after the inoculation, was attacked some months later, and after exposure to an infection of unusual intensity, with fatal yellow fever.

After excluding the fifteen incomplete observations of Group I., fifty-two cases remain to be considered which may be conveniently arranged under three heads:

Mild acclimation (Groups II., III., IV.) .	48	cases =	92.2 per cent.
Acclimation with regular yellow fever—cured	3	" =	5.9 "
Fatal yellow fever	1	" =	1.9 "
	52		

The next point was to obtain reliable data for comparison. I was fortunate in receiving from two religious communities placed under my medical charge the authorization to practise my inoculations on such members as would be willing to submit to them. These communities are those of the Jesuit and Carmelite Fathers, established in the city of Havana. Their members are partially renewed almost every year by the arrival of new-comers from Spain to substitute others who have resided several years here. Since 1883, every year except 1885 I have inoculated some of the new-comers, while others did not go through that ordeal. During the period 1883–1890 the Jesuit Fathers have had thirty-six inoculated and seven not, and the Carmelites had thirteen inoculated and twenty-five not inoculated. Of the inoculated none have died of yellow fever, whereas five of the non-inoculated have died of it (one Jesuit and four Carmelites). After deducting from the inoculated thirteen cases still under observation, we have thirty-three inoculated and thirty-three not inoculated members of the same communities, having arrived in the same years as the former, leading the same life and exposed to the same chances of infection.

	Inoculated.	Not inoculated.
Mild acclimation (Groups II., III., IV.)	31 = 94 p. c.	21 = 65½ p. c.
Acclimation with regular yellow fever —cured	2 = 6 "	6 = 19 "
Died of yellow fever—none of the inoculated, but of the non-inoculated	... ...	5 = 15½ "
	33	32

The conclusions which the above statistical results, together with the comparative observations, appear to justify are as follows:

1. The inoculations with one or two recently contaminated mosquitoes, in the manner practised by ourselves, is free from danger, inasmuch as the numerous trials which have been made have produced at most (in about 18 per cent. of our cases) a mild attack followed by immunity.

2. We must attribute to the influence of the inoculations with contaminated mosquitoes: 1. The mild acclimation observed in 94 per cent. of our cases, whereas the same desirable result has only occurred, *cæteris paribus*, in 65½ per cent. of the non-inoculated; 2. The reduction of cases of regular yellow fever to the proportion of 6 per cent. instead of 19 per cent.; and 3. That of fatal yellow fever to less than 2 per cent. instead of 15½ per cent., one single death from yellow fever having occurred among the sixty-seven persons inoculated by us since 1881 until the present date.

3. The contaminated mosquitoes appear to lose either partially or completely their contamination after they have stung healthy subjects; whereas the contamination appears to become intensified by successive stings of the same insect on yellow fever patients.

4. The inoculations performed during the colder season should not be considered to afford sufficient protection, but should be repeated on the approach of the hot season.